

RETAINING WALL LEVEL BACKFILL B-7

A building permit is required for retaining walls in excess of three feet. This measurement is taken from the top of the footing to the top of the masonry. Retaining walls of any size supporting a surcharge other than soil also require a building permit. Retaining walls which do not require a building permit may use the following standards for construction. Contact the Building Department for information on how to obtain a building permit for a retaining wall.

I. INSPECTIONS

- Inspections must be performed and approved during several phases of retaining wall construction. Please call for an inspection at the following times:
- When the footing has been excavated, the reinforcing steel is tied into its final position, and the site is ready for concrete to be placed, a foundation inspection is required.
- An inspection of the wall reinforcement and masonry unit lay-up is required before grouting the wall.
If clean out holes are used, masonry may be laid to the full height of the grout pour before calling for the inspection. Grout shall then be poured in a continuous pour in lifts not exceeding six feet.
If clean out holes are not used, a pregrout inspection is required prior to each grout pour. Block cannot be laid higher than the grout pour. Note that cleanouts are required for all grout pours in excess of five feet.
- After grouting is complete, and wall drain systems are in place, a backfill/drainage inspection is required.
- When all backfill and fine grading operations are finished, a final inspection is required.

II. WALL HEIGHT

Retaining wall height is measured from the top of the footing to the top of the wall. Walls not shown in Table A in this hand out must be specifically engineered for the particular circumstances. The walls shown herein are designed to retain earth banks with a level backfill. No building, foundation, swimming pool, driveway, or other loading from the upper level above the retaining wall is allowed without supplemental engineering of the retaining wall. This is measured within a distance equal to the height of the retaining wall.

III. MASONRY

All masonry units must be type "N" grouted solid with $f_m = 1,500$ psi.

IV. MIX DESIGN REQUIREMENTS

Note that Plastic Cement is not permitted to be used in retaining walls in Seismic Zone 4.

- Footings
 - The concrete mix for footings must meet a compressive strength of $f_c = 2,000$ psi minimum or the following proportions by volume:
 - 1 part Portland cement
 - 2 ½ parts clean washed sand
 - 3 ½ parts ¾ inch maximum size gravel
 - 7 gallons of water per 90 pound sack of cement
- The mortar mix must have a minimum compressive strength equal to 1800 psi. One possible mix to attain this strength is:
 - One part Portland cement
 - 3 1/2 Parts clean washed sand
 - ¼ part hydrated lime or lime putty
- Grout must have a minimum compressive strength of 2,000 psi. One possible mix to attain this strength is:
 - One part Portland cement
 - 3 parts clean washed sand
 - 2 part pea gravel (3/8 " aggregate)

Add water until pouring consistency is achieved without segregation of the grout constituents. Mechanically vibrate grout into place immediately. Re-vibrate grout about 10 minutes after pouring to ensure consolidation. Stop grouting 2" below top of masonry units when second lift is to be continued at another time.

Note: All cells must be filled solid with grout.

V. MORTAR KEY

To insure proper bonding between the footing and the first course of masonry, a mortar key must be formed in the top of the footing. Embedding a 2X4 flat and flush into the freshly poured footing will achieve this mortar key. The wood should be removed after the concrete has begun to harden (about 1 hour). A mortar key may be omitted if the first course of masonry is set into place into the fresh concrete when the footing is poured and a good bond is achieved.

VI. WALL DRAINS

Wall drains (4 " diameter) must be placed at 6 foot intervals along the entire length of the wall. The wall drain outlets should be placed just above the level of the soil or finish paving on the front face of the wall. Drains may be formed by placing a block on its side at 6 foot intervals, by leaving out the mortar in the vertical head joints between all the blocks on the first course above finish grade on the face side of the Wall by any other acceptable , equivalent method. Backfill behind the wall drains or open head joints must be loose rubble or gravel 12 inches wide and extending from the top of the footing to the top of the wall.

VII. SOIL

Wall design, footing sizes, and reinforcing steel are based on an active earth pressure with an equivalent fluid weight of 30 pounds per cubic foot. All footings must extend at least 12 inches into undisturbed natural soil or compacted fill which has been compacted to at least 90% density. Soil should be dampened prior to placing concrete in footing excavations. A soil report prepared by a licensed civil engineer may be required if there are site complications.

A minimum 7 feet must be provided horizontally from the toe of the slope to daylight (face of the slope) where the ground slopes away from the wall. Footing sizes given in Table A are based on a 1,000 psf maximum soil bearing value; use of a larger bearing value will require design and testing by a licensed architect or civil engineer specifically for existing conditions. A soil report prepared by a licensed civil engineer may be required if there are site complications.

VIII. REINFORCING STEEL

Reinforcing steel must be deformed and comply with ASTM specification A615-85, Grade 40 or 60. When one continuous bar cannot be used, a lap or splice bar of 40 bar diameters is required.

Two #3 bars must be placed longitudinally in the footing as shown in Figures 1 and 2.

For 6 inch or 8 inch blocks, one #3 reinforcing bar must be placed longitudinally in the center of the wall in a mortar joint every 16 inches as the blocks are laid up. For 12" block, one #4 reinforcing bar must be placed longitudinally in the center of the wall in a mortar joint every 16 inches as the blocks are laid up.

Table A / Requirements for Various Wall Heights ^{1,2,3}

Wall Height (H)	Wall Type	Toe Dimension (L)	Footing Width (W)	Key Size (K)	“A” Bars (A)	“B” Bars (B)
1’4”	III	2”	1’3”	None	#3’s @ 24” o.c.	None
2’0”	III	2”	1’6”	None	#3’s @ 24” o.c.	None
2’8”	III	3”	1’10”	None	#3’s @ 24” o.c.	#3’s @ 48” o.c.
3’4”	III	4”	2’1”	None	#3’s @ 24” o.c.	#3’s @ 48” o.c.
4’0”	IV	6”	2’6”	None	#4’s @ 24” o.c.	#3’s @ 32” o.c.
4’8”	IV	11”	2’11”	None	#4’s @ 24” o.c.	#4’s @ 24” o.c.
5’4”	IV	12”	3’2”	6”X6”	#4’s @ 16” o.c.	#4’s @ 24” o.c.
6’0”	V ⁴	16”	3’10”	8”X8”	#4’s @ 16” o.c.	#4’s @ 24” o.c.
6’8”	V ⁴	16”	4’4”	8”X8”	#4’s @ 16” o.c.	#4’s @ 16” o.c.
7’4”	V ⁴	16”	5’0”	12”X12”	#5’s @ 16” o.c.	#4’s @ 16” o.c.
8’0”	V ⁴	20”	5’8”	12”X12”	#6’s @ 16” o.c.	#4’s @ 16” o.c.

Footnotes

1. Footing sizes are based on 1,000 psf maximum soil bearing value. The resultant is within the middle third of the footing.
2. Walls not shown in Table A above must be specifically designed for the actual condition by a licensed engineer.
3. All Construction must comply with the specifications shown in this information bulletin.
4. When wall Type V is required, the first 32 inches of masonry block, regardless of wall height, must be 12” wide masonry units.

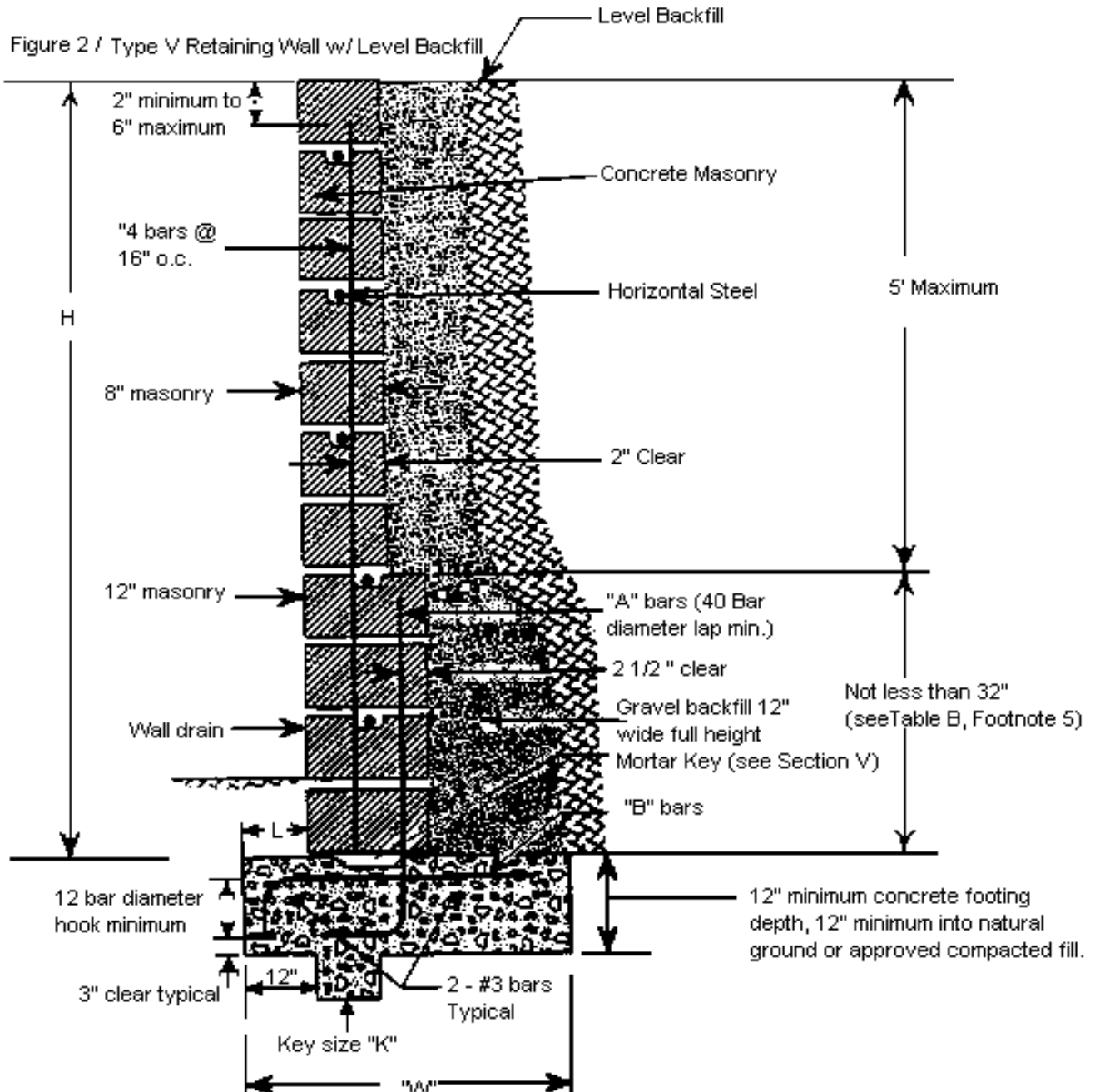
Figure 1 / Type III or IV retaining wall with level backfill

The diagram illustrates the cross-section of a retaining wall. The wall has a total height H and width W . It features horizontal steel reinforcement bars spaced at intervals of L , with a 2-inch clear space between them. The wall thickness is specified as 6 inches for Type III and 8 inches for Type IV. A gravel backfill, 12 inches wide and full height, is shown behind the wall. Mortar keys are present in the wall face. At the base, there is a concrete footing with a minimum depth of 12 inches, founded into natural ground or approved compacted fill. The footing contains two #3 bars typical. A key size K is indicated at the bottom center. A wall drain is shown on the left side. The top of the wall is labeled "Level backfill".

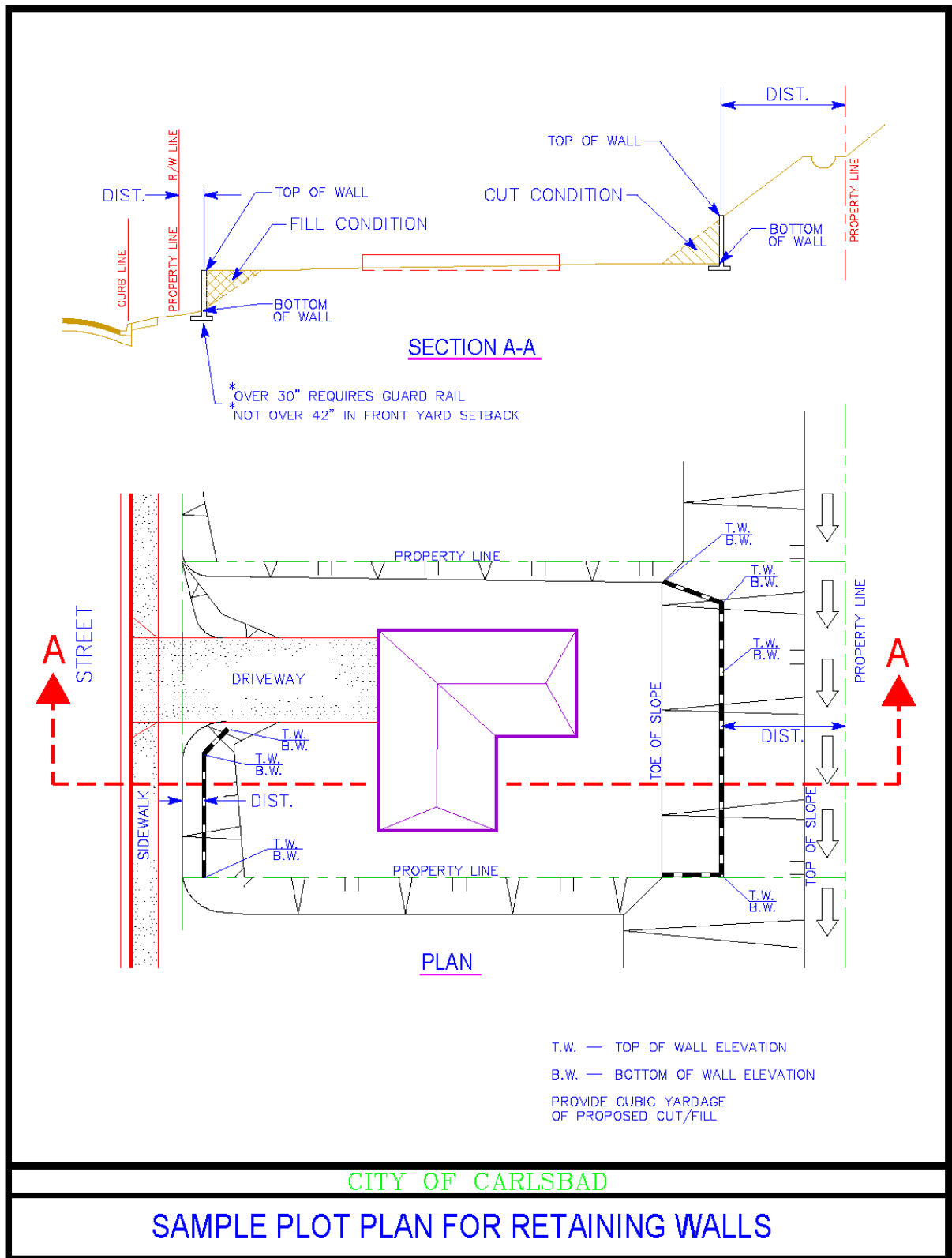
Labels and dimensions:

- Level backfill
- Horizontal steel (see Section VIII for applications)
- Wall thickness
6" for Type III wall
8" for Type IV wall
- 2" clear
- "A" bars
40 bar diameter lap minimum
- Gravel backfill 12" wide full height
- Mortar key (see Section V)
- "B" bars
- 12- bar diameter hook minimum
- 3" clear typical
- 6"
- 2 - #3 bars typical
- Key size K
- 12" minimum concrete footing founded 12" minimum into natural ground or approved compacted fill
- Wall drain
- H
- W
- L

Note: A minimum of 7 feet must be provided horizontally from the toe of the footing to the face of a slope or daylight where the ground slopes away from the base of the wall.



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BUILDING PLANCHECK CHECLIST FOR RETAINING WALLS

1. Provide a fully dimensioned site plan drawn to scale. Show:

- ♦ North Arrow
- ♦ Easements
- ♦ Existing & Proposed Structures
- ♦ Retaining Wall(s)
- ♦ Property Lines (dimensioned from street)
- ♦ Show Proposed location(s) of walls
- ♦ Show wall heights (top of wall-TW and bottom of wall-BW) at ends of walls, tallest points of wall & at points of height change.

2. Show on site plan:

- ♦ Drainage patterns
- ♦ Existing and proposed slopes
- ♦ Existing topography

3. Include on plans:

- ♦ Site address
- ♦ Assessor's parcel number
- ♦ Legal description

Grading quantities: Cut _____ Fill _____ Import/Export _____